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Notes.

A woolen mill is to be built at Stockton, Cedar County, Mo.

A reaper manufactory is to be established at Des Mo nes, Iowa.

An extensive flouring mill is soon to be started at Appleton, Wis.

An important shipment of American ribbons has lately been made to England.

The woolen mills at Barry, Ill., will resume operations about the 1st of March.

An extensive agricultural implement manufactory is soon to be established in Onawa, Iowa.

A company has been formed at Independence, Kansas, with a view to coal mining at Fort Osage.

Several mills at Minneapolis, Minn., which have been idle for some time have resumed operations.

Marysville, Mo., has organized a society for the purpose of establishing manufactories of different kinds.

Toronto people are in favor of the city's giving a bonus of $200,000 towards the erection of Iron Smelting Works in that city.

In Richland county, Wisconsin, the farmers have built a wooden railway, sixteen miles long, costing only three thousand dollars per mile.

The Capital City Rolling Mill at Indianapolis, Ind., has resumed operations, giving employment to 120 men who have been idle since its suspension.

A bill has been passed in the Iowa Legislature requiring County Surveyors to record their field notes, and fix ing their salary at four dollars per day.

Mr T. D. Simers, late of the Chicago, Rock Island and Pacific railroad, has been appointed Statistical Clerk in the office of Secretary Randolph of the Board of Trade of this city.

The track of the Atchison, Topeka, and Santa Fe railroad is completed to Pueblo, Col., and now southern Colrado has a direct broad-guage railroad connection with the Eastern States.

There are forty or fifty hands at work grading on the Atlantic and Erie railroad, some two or three miles east of Granville, Ohio. It is designed to have the cars running as far as Granville by the first of June next.

It is stated that Peterson, the Government engineer on the Montreal, Ottawa and Western railroads, refuses to approve the claims of the engineers, on the ground that the work as far as completed is not properly done.

Holders of the first and second mortgage bonds of the Lake Superior and Mississippi railroad of Minnesota, have agreed to a plan of recognition of the company, as proposed by the commitee of the bondholders in January.

The Supreme Court of the United States has decided that Council, Bluffs on the Iowa side of the Missouri river, is the eastern terminus of the Union Pacific railway, and that the Omaha Bridge is a part of the road, and must be operated in connection with the whole line.

The track of the Denver and Rio Grande Road is being pushed rapidly south, and soon these two roads will monopolize the carrying trade to New Mexico and Arizona. Tuesday, March 7, has been designated as the day for a grand celebration in Pueblo in honor of the event.

The Council Bluffs people are jubilant over the recent decision in favor of their city, and steps have been taken to erect a Union depot for the Union Pacific, Chicago, Burlington and Quincy, Chicago and North Western, St. Louis, Kansas City and Council Bluffs, Chicago, Rock Island and Pacific, and the Sioux City and Pacific railroads.

The rails of the Canada Central railway extension are laid to within ten miles of Pembroke on the Upper Ottawa river.

The *Ottawa Citizen* says that the Corporation of Montreal is greatly excited over the fact that Hogan and Beaufort, brick contractors, have been supplying bad brick. The Corporation says 75 per cent are useless.

From the *Marquette Journal* we learn that it may be considered a certainty that the construction of the Marquette and Mackinaw railroad will be commenced early in the spring and pushed rapidly to completion. The parties who have taken hold of the project are men of large means, and there are no contingencies in their way except a final arrangement of minor details with the State Board of Control, in which particular no difficulty is apprehended.

Report of progress on the Sutro tunnel for the week ending February 1, 1876, the header being 8 x 10 feet:

Number of feet driven at last report	12,026
Number of feet driven since	80
Total number of feet in tunnel	12,107

Quantity of water, 54 miners' inches; temperature of water at mouth, 75 degrees; at shaft no. 2, 80 degrees; at header, 84 degrees. Temperature of air at mouth, 49 degrees; at shaft no. 1, E., 77 degrees; W., 70; at shaft no. 2, E., 80 degrees; W., 81; at header, 85 degrees.—*Sutro Independent.*

The l egislature of Montana Territory has voted in favor of giving the Northern Railway Company a subsidy of three and a half millions of dollars to aid in promptly extending the road from Bismark five hundred miles westward, and the Utah Northern narrow-guage railroad a subsidy of $1,500,000. Montana now has no railroad. The extension of the Northern Pacific into Montana will give that territory an instant and powerful stimulus in growth, as it will open her rich mines and other valuable possessions to market and to settlement. No doubt the territory would receive the worth of its money within less than a year; and it would be repaid many times over in ten.

It being the usual practice of American Engineers to run railroad curves by equal angles, subtended by equal chords, it requires no little care to read the vernier for every angle, especially when there are degrees and minutes to set off. With the "Equal Arc Meter," a recent invention, attached to the limb of the instrument, it is only necessary to read the vernier in turning the first angle; this being done very carefully, the meter is then set, requiring but a minute's time, when the angle which may be anything from one minute to five degrees, may be repeated any number of times without again reading the vernier, thus avoiding all posssbility of mistakes and enabling the transit man to turn off the angles as fast as the chainmen can measure the chords. The proceedings necessary for procuring a patent on this invention have already been commenced.

RAILWAYS AT THE WEST.

(From the New York Post.)

The Western States, in one remarkable instance, are beginning to see that legislative interference frightens away capital. The legislatures of several of those States have laid a heavy hand upon the railways, and the consequence is that no more railways are constructed. We are aware that one reason for the entire cessation of enterprise in this department is the badness of the times; but there are parts of the West recently brought under cultivation where huge granaries are filled from the fields in their first stage of fruitfulness, and where the farmers are longing to see the ground broken for new railways to take their abundant stores of grain to market, and bring back in exchange the products of the East. That railways, if built, leading to these regions, would have plenty of freight, there can be no doubt, but the capitalist holds back for the reason that the Legislature assumes the right to say what shall be the measure of his profits. He may build a very convenient road, and it may be kept running with trains bearing freight, and yet be so regulated by the State Legislature that the capital invested shall yield no return. The railroad is as important to the Western farmer as the plough and the reaping machine. If the Legislature of Iowa were to make a law that no ploughs or reaping machines shonld be sold in that State except for half price, the makers of those implements would not be apt to send them to Iowa for a market. Coffsiderations akin to these are forcibly put in an article which we here quote from a journal entitled the *Hawkeye*, published at Burlington, in the State of Iowa:

"Among the questions that will demand the attention of the Legislature this winter is that of railroad legislation. It cannot be denied that the action of most of the Western States of late years on the question has had much to do with the almost total stoppage of railroad building. It is true that railroad building was overdone and that, in the heat of the struggle, many hastily and badly constructed roads were undertaken. But Iowa still wants railroads. The State is not yet sufficiently supplied, and instead of placing obstacles in tne way of their construction, we should do all in our power to encourage them. This we are not doing by our present attitude. Whatever the legal powers of the State may be over roads built under old laws, there can be no doubt of the State to say to all new roads, 'We propose to regulate you, and if you build you do so in that clear understanding.' This power we have never heard denied, and this is exactly the present condition of things. We have passed a law which in effect says to all capitalists: 'You may invest your money in Iowa farms and manufactures and in trade, and you shall be free agents, but if you invest in railroads you do so subject to the right of the Legislature to fix, at any time, what you may charge.' Now can we expect that railroads can be built while this condition of things exists? Here and there the older lines will build a plug to supply some certain locality, but no new enterprise will be undertaken with outside capital, so long as we say, in substance, by our laws, that we do not give it equal protection with all other property. Nebraska, newest of all the States but one, and most needing railroads, has gone so far as to put a clause in its new Constitution, adopted last fall, to the effect that the Legislature shall regulate railroads. The folly of such a notice to capital will become apparent to those who voted for it as time goes on. All or nearly all of the Western States have passed laws to keep out new railroad capital. This, then, is Iowa's opportunity. Let us take down the bars and invite to Iowa money to build railroads and guarantee to it the same protection we give to all other industries. The money will not come unless we do this. Why should it? If the price of wheat was limited by law, would Iowa farms be worth what they are now? If our legislature, this winter, will take steps to inform the world that Iowa wants railroads, and has sense enough to see that people will not build railroads there unless protected in their use, we should at least get the start of some of our more short-sighted neighbors. Let us make Iowa the best field in the west for railroads, as it is now best for almost everything else. It is no answer to say that the present legal rates are remunerative to the roads. The roads deny this. But whether they are or not, they may be reduced at this or the next session of the Legislature, and without some clear argument that the State will not attempt to exercise its right to regulate, capital, the most timid of all things, will stay away. Make police laws for railroads, but leave them commercially free. This is what all the States will come to sooner or later, because the inexorable laws of trade demand it. The only question is, which one of the States will move first and show its superior wisdom. We trust it will be Iowa."

American Institute of Mining Engineers.

(Reported for Engineering News.)

The winter session of this flourishing Society was held during the past week in Washington, D. C., commencing on Tuesday evening, Feb. 22, and ending Saturday the 26.

Before entering on our detailed report of the proceedings, it may be well to give such of our readers as are unacquainted with the position of this Society in American Engineering, a short resume of its history and present status.

Since its founding in 1871, the Institute has taken a prominent and leading position in the discussion of mining and metallurgical questions in the United States, and its transactions are much prized abroad as embodying a series of papers, containing communications of great value to the profession.

The Institute from its inception has professedly been opposed to any local bias. Its membership extends from California to Maine, and its meetings have been held at many points of interest ranging from Boston to St. Louis. The innate strength of this influential society lies in its essentially national character. It has no local habitation, and no individual interests; hence the wide-spread character of its membership.

The Institute was organized at Wilkesbarre, Pennsylvania, in 1871, for the purpose of promoting the arts and sciences connected with the economical production of the useful minerals and metals, and the welfare of those employed in these industries, by means of meetings held at various points, both for social intercourse and the reading and discussion of professional papers, which latter are circulated among the members and associates, and published at large throughout the country.

Since its organization the Institute has been holding at first four, and of later years three, meetings, during the year, namely: in May, which is considered the annual reunion, in October, and in February.

The last meeting prior to the one just held, was at Cleveland, Ohio, October last. The Institute held there a session of nearly a week, the members visiting many points of interest in the vicinity. Among the excursions organized was one to the Mahoning Coal-fields in Pennsylvania.

Owing to the approaching Centennial Celebration and the expected presence of many foreign members, the Institute has decided for the eight months from April 1, to December 1 1876, to open a suite of rooms in Philadelphia. These will be suitably furnished and attended, and provided with the daily journals, scientific periodicals, geological and professional reports, maps, guide books, railway tables, etc., for consultation; besides which the resident Secretary of the Centennial Committee of the Institute will be on hand and prepared to furnish information, advice and letters of introduction to members or guests interested in special lines of professional inquiry, whether in the exhibition itself, or in the country at large.

The next meeting of the Institute instead of being held in May as usual, has been adjourned to between the 20th and 30th of June, 1876, and is to be held in Philadelphia, the change of time being made for the object of enabling members to be present at a date sufficiently long after the opening, to ensure the exhibition being in good shape. The annual session of the American Society of Civil Engineers is to be held at the same time, and the two Societies propose extending and ratifying the mutual bonds of interest that have ever held them.

But to return to the Washington session just concluded. The meetings were held at the Smithsonian Institution, and the selection of such a location seemed peculiarly appropriate for the winter meeting, which, owing to the inclemency of the weather, is generally a strictly in-door one, devoted to the reading and discussion of papers, while the autumn and spring meetings afford opportunity for excursions to points of professional interest.

Among the members present at the session were,

Chas. A. Ashburner, Philadelphia, Geo. Asmus, New York, Chas. E. Billin, Philadelphia, John Birkenbine, Philadelphia, Prof. W. P. Blake, New Haven, Conn., E. Borda, Philadelphia, J. L. Boyer, Temple, Pa., J. H. Bramwell, Quinnemont, W. Va., S. M. Buck, Coalburgh, W. Va., Prof. J. A. Church, Tarrytown, N. Y., Jas. E. Clayton, Ore Knob, N. C., W. B. Cogswell, Mine La Motte, Mo., Martyn Coryell, Richmond, Va., E. B. Coxe, Drifton, Pa., W. E. C. Coxe, Reading, Pa., W. S. De Camp, Boonton, N. J., A. B. De Saules, Orange, N. J., Ch. A. Dresser, Brooklyn, N. Y., H. S. Drinker, Philadelphia, P. H. Dudley, Cleveland, Ohio, Cap. C. E. Dutton, Washington, D. C., A. Eilers, N. Y., A. Faber du Faur, N. Y., H. Firmstone, Easton, Pa., F. Firmstone, Longdale, Va., Clark Fisher, Trenton, N. J., Prof. P. Frazer, Jr., Philadelphia. Prof. B. W. Frazier, Bethlehem, Pa., Jos. S. Harris, Pottsville, Pa. O. J. Heinrich, Midlothian Colliery, Va., A. S. Hewitt, N. Y., A. L. Holley, N. Y., Prof. T. Sterry Hunt, Boston, Mass., R. W. Hunt, Troy, N. Y., Jos. C. Kent, Phillipsburg, N. J., C W. Kimpton, Newburyport, Mass., W. Maltby, Braidwood, Ill., Muckley, Hokendauqua, Pa., W. G. Neilson, Philadelphia, Ed. Nichols, Tarrytown, N. Y., I. P. Pardee, Hazleton, Pa., C. O. Parsons, Steel Works, Dauphin Co., Pa., J. B. Pearse, Philadelphia, J. C. Platt, Waterford, N. Y., Prof. F. Prime, Jr., Easton, Pa., J. C. Randolph, N. Y., R. W. Raymond, N. Y., G. H. Reynolds, N. Y., P. De P. Rickets, N. Y., C. W. Roeper, Bethlehem, Pa., R. P. Rothwell, N. Y., W. P. Shinn, Pittsburg, Pa., Prof. B. Silliman, New Haven, Conn., David Smith, Washington, D. C., Prof. J. C. Smock, New Brunswick, N. J., W. J. Taylor, Chester, N. J., Prof. R. H. Thurston, Hoboken, N. J., J. Brisben Walker, Washington, D. C., S. B. Whiting, Pottsville, Pa., Prof. H. Wurtz, Hoboken, N. J., C. A. Young, Philadelphia.

The total number of new members and associates elected, amounted to 73, and the total membership of the Institute is now approaching 600. Among the new members we noted the names of, General E. Burd Grubb, Burlington, N. J., Dr. J. Lawrence Smith, Louisville, Ky., Prof. Chas. Mc Millan,, Princeton College, N. J. Calvin E. Brodhead, Esq. Bethlehem, Pa., Prof. Lewis M. Haupt, University of Pa., Major J. W. Powell, Washington, D. C., Com. Lucius A. Beardslee, Washington, D. C., Gen. Wm, Sooy Smith, Maywood, Ill., James Burden, Esq., Troy, N. Y., Gen. W. S. Rosecrans, San Rafael, Cal., R. H. Lee, Esq., Supt. Logan Iron and Steel Co., Lewistown, Pa., M. L. Brosius, Esq., Supt. Standard Steel Works, Lewistown, Pa., Max Morehead, Esq., Pittsburg, Pa., E. P. Jones, Esq., Pittsburg, Pa., Heber S. Thompson, Esq., Engineer Girard estate, Pottsville, Pa., M. D. Valentine, Esq., Woodbridge N. J., Channing M. Bolton, Esq., Civil Engineer, Richmond, Va., Wm. Burnham, Esq., Philadelphia, E. R. Waite, Esq., Gas Furnace Engineer, Philadelphia.

That venerable Father of American science, Prof. Joseph Henry, was present, and gave the opening address of welcome to the Institute, at the first meeting on Tuesday evening, Feb. 22d. Prof. Henry enlarged on the reservoirs of force accessible to the human race, to which we can look for the development of energy in the future. His address was ably and fittingly responded to by the President of the Institute, Mr. R. L. Holley, of New York, so well known by his researches as an expert in the manufacture of Bessemer steel.

Mr. Holley enlarged on the theme of "Technical Education," a subject full of interest at the present day, when our schools and colleges are yearly sending forth hundreds of young men, nominally engineers, miners, architects, and chemists, who in reality are often but half trained, and half prepared for either the theoretical consideration or the practical performance, of the duties opening before them. He advocated strongly a more liberal policy on the part of our miners and operators, so that students might be allowed more thorough access to various works throughout the country; not an opportunity for a desultory and hasty inspection, such as is often given, but a chance to enter and work for months as artisans, so that they might particularly become acquainted with the details of their professions.

After the delivery of Mr. Holley's address the subject was taken up and discussed with great interest up to the time of adjournment of the meeting, among those participating being Messrs. Raymond, of New York, Coxe of Drifton, Weeks of Chicago, Prof. Egglestone of the Columbia school of Mines, Dr. A. Sterry Hunt of Boston, and others.

The second meeting was held on Wednesday morning (23d), opening at 10 o'clock. Papers were read by Dr. T. Sterry Hunt on "The Cornwall Iron Deposit," and by Prof. B. Silliman of Yale, on "The Working of Low Grade Copper Ores." Also a preliminary report of the Committee on Refractory Materials was produced embodying a valuable discussion of the subject by the Chairman, Prof. T. Egglestone, of the school of Mines, Columbia College, N. Y.

Notice was given by Mr. E. C. Pechin of Dunbar, of a motion to be made at the next session in June, to change the name of the Institute to that of the "American Institute of Mining and Metallurgy."

At the close of the meeting the President gave notice that the Institute had received an invitation to visit the navy yard during the afternoon, and that several gentlemen were in attendance to conduct the members thither.

3d Meeting, Wednesday at 8 P. M. opened with a paper by O J. Heinrich, Esq., on the Midlothian Colliery, Va., followed by Prof. Henry Wurtz of Hoboken, with a paper on "The Geometry of Chemistry" elaborating a theory just discovered by himself, by which the *Diameters of the Molecules composing a body may be measured.* This theory, if not overturned, and there seems every probability of its being a true discovery, will be partially revolutionary in its character, on modern chemistry, and Dr. Wurtz may take place with the leading names of those who have brought science to its present standpoint.

Mr. Henry S. Drinker of Philadelphia, followed with a communication bearing on a work treating of Modern Tunnelling, on which he is engaged, and in the collection of data for which, he desired to enlist the aid of fellow members of the Institute. Messrs Raymond, Coxe, and Rothwell strongly endorsed the object and character of Mr. Drinker's treatise, stating that they had individually been active contributors to it. The President closed the discussion by calling attention to the fact of there being an urgent need in the profession for a thorough work on the subject of Tunnelling, ending with a call to members of the Institute to assist in the work by the contribution of any data in their possession.

A special session was held on Thursday the 24th, at 9 A. M., to give Prof. Wurtz a further opportunity of elaborating his theory of the "Measurement of Molecular Diameters."

Fourth Regular Meeting, Thursday, 24th, at 10 A. M., opened with a paper by Prof. F. Prime, Jr., of Lafayette College, Easton, Pa., on "What Steel Is," being an answer to Mr. Holley's paper at Cleveland,—"What Is Steel." Prof. Prime opposed some of the positions assumed by the President, and a lively discussion ensued.

A paper by Dr. A. Wendel, of the Albany and Rensselaer Iron and Steel Co., Troy, N. Y., was next read by R. W. Hunt, Esq., (of the Bessemer Steel Works, Troy) the subject of the communication being "The Effect of Manganese on Phosphorus in Bessemer Metal."

Mr. A. Eilers, of New York, followed with a paper on "Ferro-Manganese," with a number of experiments by Mr. Ward in Georgia, on the same subject, discussed by Messrs. Firmstone, Pearse, and others.

Prof. T. Eggleston then presented a paper on "Canfield's Mineral Dresser." This is a most striking and useful machine, just patented, and is intended for the dressing of geological and mineral specimens. It works with great delicacy and strength, and with entire safety to the specimens. It weighs in all not over fifty pounds, and the price is under $25. Prof. W. P. Blake, Curator of the Mineralogical Collection of the Smithsonian Institute at the Centennial, followed with a strong encomium of the value to collectors, of this machine. Prof. Eggleston stated it had been in steady use now for some months in the collection of the School of Mines of Columbia College.

Mr. George Asmus, of New York, then read a paper on "Alchemy, the Foundation of Chemistry." He stated, before beginning, that while in Germany, some years since, the idea had struck him to write a "Stunning Book," and that by a strict assiduity he had succeeded in collecting, during the past four or five years, the materials for a part of the preface, with an abstract of which he would favor the Institute.

Mr. Asmus' paper was extremely interesting, and decidedly, as usual, comical. He traced up the records of science from the 4th century, among the Alexandrians, to the present day, touching on the interruption of scientific research in the 7th century, and its revival by the Moors and Saracens, with its wonderful spread and progress under their sway in Spain from the 8th to the 12th centuries in the schools of Cordovia. So strong did its hold become, that on the Saracens being driven out, in the 13 century, alchemy had become so deeply rooted in Europe, that by the 15th century it had spread over all Christendom. In the 17th century it reaches its highest development; from that time may be dated the fall of alchemy, and the rise of the modern grand science of

Chemistry, beginning perhaps, with Lavoisier, and ending – — —when?

The President announced, after the reading of Mr. Asmus' paper, that the Institute had been invited to visit the Government Observatory, between 12 M and 3 P. M., of which privilege a number availed themselves.

AFTERNOON SESSION—THURSDAY, 3.30.

Opened with a paper by P. H. Dudley, Esq., of Cleveland, on the "Registering of the Force Exerted in Drawing Trains." Mr. Dudley explained the mechanism of a Dynograph invented and perfected by himself. This paper was a most valuable contribution, and attracted great attention from the ingenuity and painstaking character of Mr. Dudley's researches, and the evident practical importance to railroad men of the results arrived at. A Committee composed of Prof. R. H. Thurston, of the Stevens Institute, and Mr. P. H. Dudley, was appointed to tabulate the facts contained in Mr. Dudley's paper, and to render them in such form as would contribute to the beneficial interests of railroads of our country.

A paper by Prof. Frazer, Jr., of the Geological Survey of Pennsylvania, followed on the "Lithology of the Palœozoic and Mesozoic Rocks of Pennsylvania." Interesting remarks on this paper were made by Mr. Heinrich, of Virginia, as bearing on the Midlothian formations.

Prof. Hicker of the University of Edinburg, Chief Commissioner of the Centennial Commission of Great Britain, was then introduced by the President, and made a few happy remarks, concluding by extending to the members of the institute a cordial invitation to visit his department of the Exhibition.

A paper followed on the Cedar Point Furnaces, Port Henry, Essex Co., N. Y., by Mr. T. F. Witherbee, treating principally of the use of the Whitwell Stove.

Dr. R. W. Raymond, of New York, then read a paper on the "Spathic Ores of the Hudson River",—stating that beds had been discovered and were being worked, of from 12 to 15 feet in thickness. The ore looks like a dolomite when fractured, the outside being generally oxidized to a hematite. It can be cheaply mined, and is sold at the river bank at $2.00 per ton.

Mr. R. W. Hunt, of Troy, N. Y., stated that they had tried this ore at their works, and that it had been found unfit for Bessemer steel.

The President announced, before adjourment, an invitation from the Hon. A. S. Hewitt, of New York, to the members to attend a reception in the evening, especially given to the Institute, at his residence.

The latter proved a distinguished success. Many leading scientific men of Washington were present; among them we noticed the heads of the Coast Survey, Light House Department, Signal Service, Patent Office, Naval Observatory. Also Maj. Powell, of Colorado Canon fame, Lieut. Wheeler, Dr. Hayden, etc.

FRIDAY MORNING—FEBRUARY 25, 10 O'CLOCK.

The meeting opened with a second paper by Mr. P. H. Dudley, of Cleveland, O., on the "Analysis of Locomotive Gases" which, following his former remarkable paper on his Dynograph, attracted scarcely less attention. The paper was ably discussed by Frank Firmstone, Esq., Easton, Pa., Prof. Wurtz, Mr. Coryell, and others.

Mr. Coryell, of Richmond, Va., followed with a paper on the "Diatomaceous Sands of Richmond, Va.," with notes of a tunnel driiven through the same by the Chesapeake & Ohio R. R. Co. Mr. Coryell adverted to the occurence of marine deposits in these sands, sharks' teeth, vertebræ of whales, etc., specimens of which were shown. In fact, as Mr. Coryell pointedly put it, "There was millions in it,"—that is—*millions of Diatoms.*

Mr. John Birkenbine, of Philadelphia, read a paper on "Suspended Hot Blast Stoves," which was strongly commended by Mr. F. Firmstone, of the Glendon Stove Works, Easton, Pa., and remarks made by others.

The President then called on Prof. T. Eggleston, for the report of the Committee appointed to co-operate with the United States Commission on Iron and Steel Tests. Prof. Eggleston read the following report, and presented the accompanying resolutions, which were unanimously adopted:—

The Committee appointed to co-operate with the U. S. Board for Testing Iron and Steel, and other metals, beg to report that they have communicated with the U. S. Board, and that their services have been accepted with thanks. They have examined the plans proposed by the U. S. Board, and they find them eminently judicious, and likely to lead to the most important results in both metallurgical and civil engineering, and the science of construction; and that they are likely to be of the greatest possible advantage to the United States Government itself, by furnishing results which will both lesson the expense and increase the safety of the naval, war, and civil structures which the Government have to undertake. They, therefore, beg to present to the Institute, the following preamble and resolutions, as one of the means of co-operation which will be most likely to aid the labors of the U. S. Board.

T. EGGLESTON, Chairman.

RESOLUTIONS.

Whereas, The Committee appointed by the American Institute of Mining Engineers to co-operate with the United States Board for Testing Iron and Steel, and other metals, have inquired into the plans proposed, and informed itself of the work already done by the United States Board, and has reported that the Board is in its opinion judiciously organized, and that the plans show evidence of the highest professional ability, and find that the Board has already employed a competent chemist, and equipped a chemical laboratory, where important results have already been arrived at; that a very complete testing machine has been nearly finished under their direction, which is a model both in design and workmanship; that they have already made a large number of experiments with the machines for testing now in use, and collected a large amount of information relating to tests made by the different departments of the United States Government, and other competent persons and bodies; that they have prepared for a complete series of chemical and physical tests of iron and steel, and a number of alloys which can but result in greater economy and durability of construction; that the members of the Board, who are men of the greatest professional ability, and command the public confidence, are contributing their services gratuitously; that the results to be attained are likely not only to benefit the world at large, but also to be of particular advantage to the United States Government by increasing the durability of the material which it is obliged to use, and cheapen the cost of the construction of its Naval, Iron, Light House, and other structures; therefore,

Resolved, That this Institute heartily endorses the work of the United States Board;

Resolved, That it is the opinion of this body that the United States Board for Testing Iron, Steel, and other metals should be continued;

Resolved, That the Institute respectfully petitions the Representatives to grant to the United States Board the sum of fifty thousand ($50,000) dollars, to be expended in carrying out their plans;

Resolved, That this Institute believes that such an appropriation would be judiciusly expended, and that they think it would be a real economy on the part of the U. S. Government to make the expenditure."

Prof. Thurston, of the Stevens Institute, a member of the Commission, followed with an elaborate explanation of the delicate machine proposed to be used in the experiments, which are to cover all the engineering strains. The tests are to be recorded as referring to an iron, steel or alloy of known chemical composition and physical properties, and not as being Steel No. 1, 2 or 3, as they have formerly been made, which referred to given specimens of unknown composition, but known make; they were, however, useless, except for the individual specimen, since the given material could never be reproduced.

Mr. John B. Pearse read at this meeting a paper on "Steel," presenting some curious analyses. Prof. Eggleston inquired whether samples of the same could be obtained —especially one extraordinary heat containing a percentage of 1.25 per cent. copper, stating he should like to obtain them for the use of the United States Commission. Mr. Pearse thought they could be obtained, though the analyses were made some years since.

Mr. R. W. Hunt, of Troy, followed with a paper on the "Worthington Compound Duplex Pumping Engine." Mr. E. B. Coxe, of Drifton, Va., followed with some remarks on the trouble experienced at some of his coal mines, owing to shock resulting from the sudden stoppage of the motion of water ascending through a long column pipe in a slope when the pump was changing stroke. He wanted to know whether any member had ever known of a trial being made of pumping an air-chamber at the top of the column-pipe itself. From this the air would necessarily be partially exhausted when pumping was commenced; then at the instant of changing stroke, the water, instead of being arrested and falling, would expend its energy in compressing the air in the bell. A gentleman present stated that he knew of a case some years since, in which a similar experiment had been successfully tried.

A number of papers were then read by title, to be published hereafter in the transactions of the Institute.

Resolutions of thanks to the local Committee for their exertions, and to the gentlemen who had extended their hospitalities to the Institute, were then offered by Mr. F. Firmstone, and adopted.

AFTERNOON SESSION—FRIDAY, FEB. 25, AT 3:30.

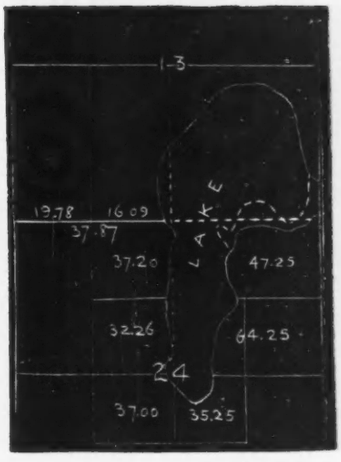
At this meeting a paper was presented by Prof. John C. Smock, of the Geological Survey of New Jersey, on the "Use of the Dip-Needle in Connection with Magnetic Iron Ore."

Also Prof. Henry Wurtz further elaborated his "Theory of Measurement of Molecular Diameters."

On Friday evening the members of the Institute attended a special reception tendered them by Prof. Joseph Henry, at his appartments in the Smithsonian Institution. The members of the Washington Philosophical Society were present, and the evening afforded the members a very delightful opportuniy of enjoying what might be fittingly termed "Social Science."

With this reception the February session of the Institute closed, and the members left on Saturday by the various routes north, south, east and west, mutually delighted with their pleasant reunion; the older members with increasing pride in the continued success of the Institute, and the new arrivals duly pleased with the practical step they had taken in professional progress, by joining an organization so strong in its foundations, and so wide in its influence.

T. 3 S., R. 15 W. Van Buren Co., Mich.



GOVERNMENT FIELD NOTES.

North on East boundary of Sec. 24, 80 chains. Set post corner to secs. 13 and 24, and also for meander post, on south side of lake. Witnesses found all right.

North on East boundary of Sec. 13, 4.50. Over lake set post on north side. Witnesses also found all right.

East on Random, between 13 and 24

37.87 To lake.

40.00 Temporary qr. post in lake.

79.02 Intersected East boundary, 25 l. north of post west corrected line between secs. 13 and 24.

39.51 Qr. sec. corner in lake.

41.15 Over lake, set post on west margin. Witnesses found all right.

Meanders of a lake in Secs. 13 and 24.

Began at post in line of 13 and 24 on west side of lake.

S. 29½ E. 5 ch., S. 19 W. 3.5 ch., S. 2½ W. 22.5 ch., S. 19¾ E. 4 ch., S. 32¼ W. 5.5 ch., S. 32 E. 12 ch., N. 74 E. 7 ch., N. 2½ E. 9 ch., N. 13 E. 8.75 ch., N. 42½ E. 6 ch., N. 13¼ W. 9.50 ch., N. 24½ E. 8.5 ch., N. 15¾ E. 4.5 ch., N. 66¼ E. 6 ch., S. 81 E. 4 ch., N. 83 E. 9 ch., N. 78½ E 3.6 ch. to post in E. boundary of Sec. 24, south side of lake.

Such is the record left by the U. S. Dep. Surveyor, for governing the subsequent surveys of the N. E. ¼ of said Sec. 24.

Now, what do we find to be the facts in the case? We find

1st. In going from the undoubted meander post on the west side of the lake to the undoubted meander post on the east side of the lake in a direct line, we must needs pass over a high bluff, some four chains inland, while the plat represents the line as many or more chains in the lake.

5d. Assuming a reversed bearing for the final courses of the meander notes, it *is* not, and never *was* necessary for the Dep. Surveyor to go in a *Southwesterly* direction in meandering the lake.

3d. There is a manifest error in the *area* of the said N. E. ¼. Calculating the contents from the meander notes, we find instead of 111½ acres, there is but about 100 acres.

4th. And yet, if we protract the courses and distances from post to post we will find them to *close* very nicely.

Now, I ask, how are we to reconcile these conflicting conditions on any consistent hypothesis?

I will now give my plan of measuring two adjacent 40 acre parcels, per government survey, off the north side of said quarter section: First, with the *meander notes* on a *basis*, calculate how far south from the N. E. sec. corner 40 acres would extend along the Town line; set a stake and strike the line west. From this point the same for the next 40 acres, taking into account, of course, any shortage or over-plus that might occur on this said Town line between E. ¼ post and N. E. Sec. corner.

Thus No. 1 would be given to understand that he was the fortunate gainer of some 5 or 6 acres lying outside of the meander line, and *I* think also the 2¼ acres in Sec. 13; while the other party would have about even measure. Then if Uncle Sam or any other man disputed his claim thereto, they would have to come under the regulations governing uncovered beds of meandered bodies of water, as interpreted by Commissioner S. S. Burdett, in No. 5 of ENG. NEWS. A. J. PIERCE. *Co. Surveyor.*

South Haven, Mich.

ENGINEERING NEWS.

SATURDAY, MARCH 4th, 1876.

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Civil Engineers' Club of the Northwest.

Chicago, March 1st, 1876.

The March meeting will be held at the Sherman House Club Rooms, at 4:30 P. M., Tuesday, March 7th.

Paper for the evening, "*The Riparian Question*," by S. S. Greeley, *City Surveyor*. L. P. MOREHOUSE, *Secretary*.

EXPERIMENTS ON FLEXURE OF BEAMS.

The curvature, change of inclination and deflection of beams under different loads, and supported in different ways is determined by the aid of the integral calculus, as all students of the resistance of materials are well aware. In taking the first step we avail ourselves of an approximation, a supposition that a distance along the curve of the beam is sensibly equal to the horizontal projection of that distance, or that $ds = dx$. The slight deflections admissible in practice do not make the error large enough to be appreciable. The deflection of a simple beam or truss does not concern us much, farther than that it indicates the comparative stiffness of the piece, and we can see that a slight change of deflection would not be of material moment. But when we come to investigate the subject of continuous girders, and find that the equations for change of inclination and for deflection of each span must be used, in order to obtain the bending moments, supporting forces at the several piers, and the shearing forces, by the aid of all which quantities the proper proportions of the various pieces are ascertained, a suspicion may be sometimes aroused whether the approximation above referred to may not allow errors to accumulate so as to vitiate the results.

A very simple piece of apparatus may be devised for testing with a light wooden bar the results obtained by calculations from the formulæ. We will describe one used by ourselves which can be duplicated by anybody, and which, while giving satisfactory results, may be made more delicate, if desired. Near the ends of a board, about 30 inches by 4 inches, are fastened two standards of wood, the width of the board, some six inches high, and distant 25 inches from centre to centre. These standards each carry a stout iron wire thrust horizontally through them near their tops, and are cut away sufficiently to allow a light bar of wood, about 40 inches long, 2½ inches wide, and ¼ inch thick, to rest on the middle portion of the wires, which thus make the bearings for the beam of 25 inches span. There are needed also, one or two small pieces of looking-glass, some weights, a graduated rule or scale, a leveling rod and a transit, although one or both of the last two may be, if necessary, dispensed with.

The simplest case is that of a beam fixed at one end and loaded at the other. If l represent the length of the beam, in inches; I the moment of inertia, which for a beam of rectangular section is $\frac{b\,h^3}{12}$, where b = the breadth and h = the depth of the cross-section of the beam, all in inches; E the modulus of elasticity; and W the weight in pounds at the end, the formula for the deflection of the loaded end is written

$$v = \frac{W\,l^3}{3\,E\,I}$$

The value of E may be taken from the tables usually given in text books, but we prefer to determine it from the experiment on this case. Set the apparatus on the floor, allowing the bar to project a convenient known distance beyond one support, while resting on both. Place the small mirror on the bar, over the support next to the overhanging end. Set up the transit beyond one end of the apparatus and the rod beyond the other end so as to view the reflected image of the leveling rod in the mirror, sight at a point in the mirror as near as possible over the support, clamp the telescope and note the division of the rod cut by the cross-hair; measure the height of the extremity of the bar from the floor. Now hang a known weight on the free end of the bar. The end will be deflected and the mirror will move through a small angle, displacing the image of the rod. As a beam fixed at the end is to be horizontal there, place a weight on the bar between the supports and shift it, until the cross-hair cuts the original division on the rod. Measure again the height of the end of the bar above the floor, and the difference between these two measures in inches will be the deflection v. Putting these known quantities into the formula, we can compute the value of E for this bar; it will perhaps be 1,700,000.

If we wish next to experiment with a beam, supported at its ends, and carrying a single weight at any known distance from one support, we have simply to place the bar on the supports, put the mirror over one of them, get the reading of the rod as before, measure the height of the bar above the base, and then attach the weight. We can now measure the deflection at any point, can find its maximum value, the place where this occurs, and its agreement with theory. Then, by measuring the distance which the cross-hair has apparently moved on the rod and the distance from the rod to the mirror, we obtain the angle between the two incident rays, and by a law of optics the mirror has moved through half this angle. Hence we obtain the change of inclination over the support.

If the beam projects over one support we can attach a weight to the projecting portion, and bring the mirror back to its first position, when we shall have a beam fixed at one end and supported at the other. The product of this weight into its distance from the support gives the actual, to be compared with the theoretical, bending moment at the fixed point. By putting the bar on these supports we shall have a continuous beam of two spans, and the number of spans may be increased at pleasure. By two mirrors the beam may be fixed at both ends.

The weight of the bar is neglected, as the attached weights produce a definite change of inclination and of deflection for themselves, and all the measures are taken from the position assumed by the bar under the action of its own weight alone. By means of strips of lead or a row of blocks, the effect of a uniformly distributed weight may be tried. The theoretical formulæ may be found in any books treating of the flexure of beams. The experimental results will, with ordinary care, be very accurate and satisfactory.

BANGOR WATER WORKS.

The Water works for the city of Bangor, Maine, have just been completed and turned over by the contractors, the Holly Manufacturing Co., of Lockport, N. Y. The contract was executed July 13, 1875, and the works were completed Jan. 1, 1876. The water is taken from the Penobscot river, with a lift of from ten to twenty feet. The machinery consists of Holley's improved, double-acting, four-cylinder, pumping engine, each cylinder being 12" diameter and 27" stroke, and a rotary pump of a capacity of 16 gallons per revolution, to secure uniformity of flow. They may be disconnected so that any desired number may be run at once. The steam engine may be worked as condensing or compound. The piston pumps are capable of delivering 3,000,000 gallons of water in 24 hours, at a piston speed of 90 feet per minute, against a pressure sufficient to supply the upper stories of houses on ground 200 feet above the works and two miles distant. The length of piping is about 14½ miles, all sizes, 16" to 2" cast iron pipes. The contract price for works complete—hydrants, gates, etc., but including three 84" diameter turbine wheels, wheel-house, pit, raceway and accessories, in place of the steam engine, was $186,000.

The tests required by the contract, as to strength of pipes, and ability to throw water from hydrants, were all met previous to Jan. 1, in full accordance with the requirements. 12 one inch simultaneous streams were thrnwn to an average height of 130 feet, on ground at about the level of the pumps. From an elevation of upwards of 100 feet, 8 one-inch streams were thrown at once from 130 to 150 feet high. At an elevation of 150 feet, 6 streams 130 feet high; at an elevation of 200 feet 4 streams 120 feet high, besides at the same time, a 2-inch stream on the low level, 175 feet high. The contract called for streams of 100 feet only. On the hill 200 feet above the pumps, and two miles distant, a good play was made through 2700 feet of hose. One three inch stream reached a height of 240 feet.

The papers on "Heat and Combustion" by P. H. Dudley, C. E., of Cleveland, will be continued next week. The value of these articles may be inferred from the high encomiums passed on other papers read by Mr. Dudley, at the meeting of the American Institute of Mining Engineers, in Washington, as shown by our report. Mr. Dudley's conclusions are based on careful experiments long conducted by himself and are well worth the attentive study of all steam users everywhere.

We have given considerable space this week to the report of the Washington meeting of the American Institute of Mining Engineers. This Society is rapidly gaining in influence and strength, and on its list of members are many of the principal Engineers, Chemists and scientific men of this country. Membership in such a society is a valuable recomendation anywhere, and we hail with pleasure the evidences of its rapid progress, and the appreciation of its value to the profession.

It is very gratifying to us to note the evidences of a revival in trade which are being manifested in almost every part of the country. We do not note suspensions, and do not propose to: if there was less croaking about the "hard times" and failures, by the newspapers, we would have fewer of them, and if individuals would contribute their mites of encouragement it would help very materially to restore a feeling of confidence among capitalists, and through them to the general public.

The Portland *Press* describes a new nautical instrument, invented by Rev Dr. Thomas Hill, the well-known mathematician, and ex-president of Harvard College, which it is believed will be of great value to navigators. It is to be used for taking observations, and it proposes to save, in the majority of cases, the labor of taking out and adding logarithms.

An iron bridge at Reynoldsville, Pa., erected last fall, fell into the stream one day last week.

The directors of the Tuscarawas Valley railroad have selected the Flushing route for the line of their road. The other, by way of New Athens, would cost somewhat less but more towns will be reached by the road selected.

Nearly 500 men are at work in the Lagonda shops, of Messrs. Warder, Mitchell & Co., and 325 in the Champion Bar and Knife Works. About 2,000 men are now working on the several parts of the Champion machines in this city, with perhaps as many or more in other factories.

The Pennsylvania steel works at Baldwin, near Harrisburg, are running with all their force night and day, and give constant employment to about 2,000 men. During the past summer the company erected a new blast furnace at an expense of $130,000; also a steel furnace, and preparations are being made for the erection of a bar mill for the manufacture of bar steel. About $1000 of improvements have been added to the rolling mill.

Ballard, Fast & Co., manufacturers of reaper and mower knives, saws, springs, etc., Canton, recently erected an addition to their works, 240 by 100 feet, containing fifteen shaping and heating furnaces and other apparatus and macinery for the manufacture of carriage and wagon springs exclusively. This new addition gives employment to sixty men now, and the number will be soon increased to one hundred, as it is with difficulty they can keep with thair orders.

KANSAS CITY WATER WORKS.

Kansas City, the second in importance in Missouri, is situated at the junction of the Kansas and Missouri Rivers. The city proper, has a population of about 35,000 people, but in connection with its adjoining and closely contiguous suburbs has perhaps a population of 50,000. It is a very important railroad centre, and the Missouri River is here spanned by one of the most noted bridge structures in America. It is largely engaged in the cattle and grain trade, and is a principal distributing point for the regions to the South and Southwest. The main portion of the city is built on the high bluffs bordering on the river; the buildings are principally of brick; the streets are broad, and paved with wooden blocks, and are lighted with gas.

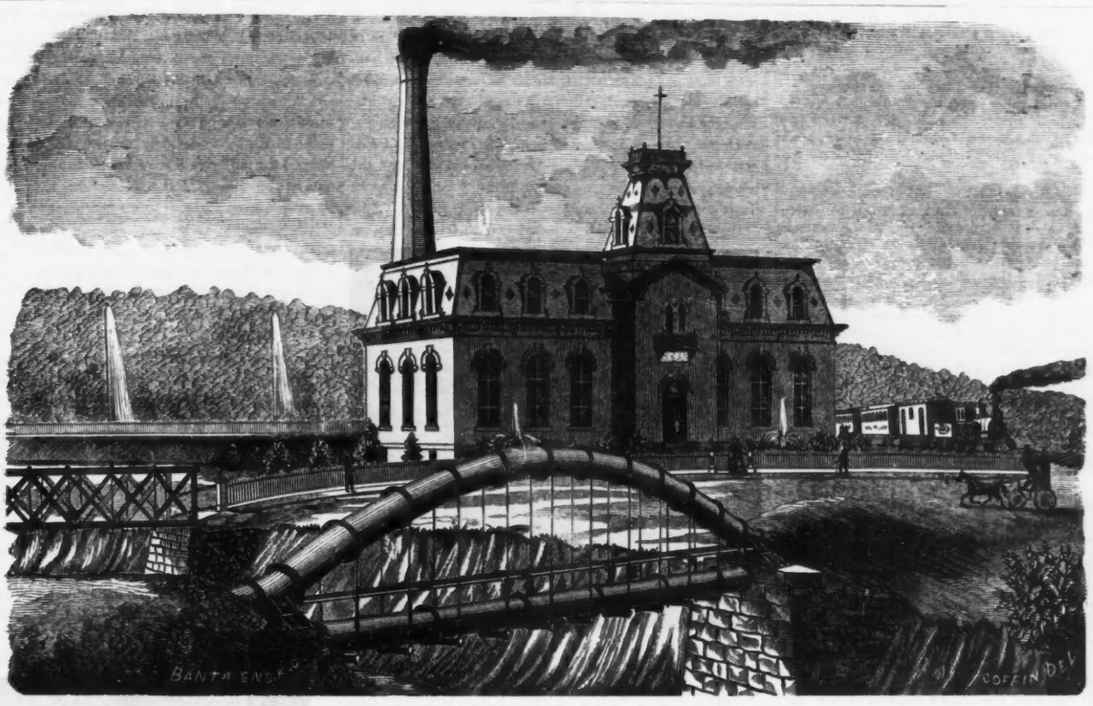
Until recently the water supply has been drawn from wells and cisterns, but on the 1st of January last the new pumping works, of which we give an illustration herewith, were put in operation, and the people now draw their supplies of water, for all purposes, from the Kansas River. In 1873 the city decided in favor of Water Works, by a popular vote of 2,322 to 74, and a contract was entered into with the National Water Works Co., of New York, for the supply of the city with water.

The Pumping House is 95x50 feet, of pressed brick; 8 feet basement; engine story is 25 feet; Mansard portion 18 feet; tower 65 feet above the ground; walls 21½ inches thick, and bonded throughout at each fifth course, the chimney is ten feet square at the base, but at the cornice changes to an octagon; its whole height is 100 feet. The engine room is finished as follows: Floor, clean, narrow yellow pine; sides wainscoated with oak and black walnut finished in oil; walls hard-finished; window caps and sills are of cut stone.

There are two reservoirs. The lower one is constructed to serve as a series of settling basins and clear water well. It is irregular in form, being curved on the sides to conform to the railroad ground; it covers about two acres, and has a capacity of 6,875,000 gallons, with concrete bottom, and sides of brick laid in cement.

The Upper Reservoir is located at an elevation of 244 feet above low water mark; it is 330 x 380 by 25 feet deep, with a capacity of 14,000,000 gallons; is built of brick laid in cement; the bottom, and about 13 feet of the sides are concreted; above this the sides are paved with limestone 12 to 20 inches thick.

For the details respecting the pumping machinery,—which was supplied by the Holly Manufacturing Company,—we are obliged to wait until we can get a more accurate description than we now have, but which we hope to be able to present next week.



KANSAS CITY, MO., WATER WORKS.

PUMPING HOUSE AND WATER MAINS OVER TURKEY CREEK.

THE LAND SURVEYOR.

LANCASTER, WIS. February 12th, 1876

EDITOR NEWS:—I fear we shall be compelled to believe that Surveying is not one of the exact sciences.

I must admit that the case furnished by Mr. Pierce is likely to develop various opinions that are difficult to reconcile. However it is not a question of surveying practice but of *law*, and this shows us that the land surveyor who fills his office must be not a mere mechanic but a sound legal adviser and tribunal, in some of the most important and intricate business affairs.

The two answers in the last number, Feb. 5th, are sadly at variance—both with each other and in some points with my humble opinion. In the first place I dont understand such a system of numbering sections by which Section 13 can lie east of Sec. 24, but as no objection has ben made on this point by either of the gentlemen who have contributed answers, I suppose the fault lies in my own ignorance, so please enlighten me.

In striking the line of two separate forty acres of land per govt. survey, etc., that survey should be considered the principal basis of operation, but the question and answer are so indefinite as to admit of various interpretations and modifications.

1. Should the govt. survey be implicitly followed?

No,—as regards the meander line, for it is not a boundary. If it were regarded as a boundary, it would lead to endless confusion and litigation.

Marginal tracts might be found everywhere almost, along our shores where land is most valuable that would be seized upon and occupied, thus cutting off the intended owners from access to the water.

In making meander corners in govt. surveying we never place them exactly at the water's edge but generally at a safe distance, in order to ensure perpetuity, and the government prohibits a close survey of the shore by prescribing that the courses shall be measured in *even chains*—all except the last or closing course, and *that* must contain nothing less than a multiple of 10 links. True, the government undertook to convey certain tracts by metes and bounds, but the shore is a *natural monument adopted and described as the boundary* and must control over course and distance.

The actual shore is the line, the *boundary* referred to both in the patent and the survey. Otherwise the meander lines would need to be *blazed* to show where possession ends, and strife and lawlessness begin.

Moreover, the government well knew that shore lines are unstable and liable to frequent or constant changes.

Parties deriving title from the government have precisely the same rights in regard to accretion, decretion and construction of the calls of an instrument as those who hold title from any other vendor.

2. *Should we follow the bold shore line.*

For what purpose? The subdivision lines of a fractional section are not controlled in the least by the area of the separate lots or the coincidence of the survey with the actual shore.

They are to be run so far as possible, exactly as if the section was not fractional, and by due North or East; I mean a course consistent with the exterior lines of the sections.

3. May not Section 24 claim the two acres in 13?

Mr. Shields has answered this question perfectly, in the negative. How could *you*, Mr. Dorr, conclude that Section 24 could claim any part of Section 13?

If the location of the section line was debatable we might suppose it to run entirely outside the land, but it is admitted that the two acres are in Section 13.

Liberal as I am in regard to shore lines, I am not prepared to stretch my opinion enough to cover two acres in Section 13. The fact that the government has not run the line, makes no difference. Such omissions are not unusual among the intricate windings of the channels and islands along the Mississippi.

I trust we shall see more opinions and a full expose of these questions in your columns. J. B.

LANSING, January 26, 1876

EDITOR NEWS:—The case submitted by A. J. Pierce in your issue of 22d inst. seems very plain to me.

The government in selling the N E frl. ¼ of Section 24, sold, or will sell, only to the meander line as run by the Dep. Surveyor. The purchaser has no rights whatever to land or water outside that line; and title to it can only be obtained by procuring a survey and sale of the alleged dry margin by a due course of red tape. Therefore the Surveyor in surveying said description must stick to the original survey. In case of a survey of the margin being ordered, should it be found to extend over the line on to Section 13, then the Section line would have to be established. The adjacent owners can only hold those margins by actual purchase after due survey by U. S. Deputy.

I would call your attention to the 2d case stated in the enclosed circular letter from the Com. of Genl. Land Office.* I think Mr. Pierce's case would be treated by that office under the case mentioned. J. E.

* Published in Engineering News of January 22.

PENNVILLE, IND., January 29, 1876

EDITOR NEWS:—The "Surveying bill" presented by B. F. D. in the NEWS of January 22d meets my most hearty approval, with the exception of some of the provisions of Sec. 2, which I would word as follows:

Sec. 2. Examiners shall give a certificate of necessary qualification which shall be valid during the life of the recipient, to each applicant whom they may deem properly qualified; and all surveying that may be done by any one holding such certificate shall be considered as official and legal, and none other. And said certificate shall be valid throughout the State.

Sec. The office of County Surveyor be and is hereby abolished; provided that nothing in this act shall interfere with present incumbents of the County Surveyor's office during their present terms.

I believe an act embodying the foregoing would raise the standard of ability in our profession, and "put it where it will do the most good," *i. e.* above political manipulations, and on the footing of a profession, where it should *be*. The bill presented by B. F. D. would fail to take it out of the gift of party.

Will some reader of the NEWS give the actual cost of narrow gauge R. Rs. compared with the standard gauge roads, considering difficulties of construction as being equal. A. R.

EDITOR NEWS:—In reply to R, page 45, issue of Feb. 5th, 1876, regarding retaining fees, would say I have for a number of years established the principle and exact a retaining fee where a party wishes services at some particular date not immediate.

I see no reason why a surveyor should be hindered or lessened in return from operating for an opposite party after the 1st party had got through with his services and by them (the 1st party) derived the benefit of a retaining fee; at any rate, if the surveyor's operations are found to be too valuable for the 1st parties to acquaint the 2d parties with, the denial of a retaining fee to the surveyor, would be contemptuously mean and without a degree of prestige in any other avocation.

As to whose property the notes of the survey are, would depend considerably upon the following considerations: If the whole survey is wholly equipped and paid for by the parties employing, I should say there could not be a doubt but that they belonged to the party employing.

On the other hand and in the case of ordinary farm surveys, etc., where a surveyor equips himself in instruments as well as field books and pencils, the notes he takes are his own property and he has the right to them.

I base my opinions on this point from the general custom I have observed in the different branches of operations.

To suggest another query, would inquire if a surveyor is obliged to divulge the area of an occasional employer to a tax assessor when the surveyor is under obligations by a retaining fee to keep a closed mouth and hand to all except the employer, and other surveyors would be glad of the chance work, dog cheap, and are of convenient access to the premises concerned and the tax assessor. NIMROD.

Adrian, February 17th, 1876.

EDITOR NEWS:—In running the line between Sections 3 and 4, the government Surveyors run North 40 chains and set ¼ post; then say the land being wet and swampy, they proceed no further. Consequently they set no stake on the township line between said sections. The south line of Sectisn 3 is 79.46 chains in length, and the south line of Section 4 is 81.20 chains long. Now, will you or some of your correspondents, direct the proper location of said missing stake, and much oblige a subscriber. B. K.

Ans. I would run due North with a variation which would be the mean of the East line of Section 3, and the West line of Section 4, to the town line and set a corner. [ED.]

PORTLAND, OREGON, Feb. 9th, 1876.

EDITOR NEWS:—In reply to A. G. Pierce's communication on page 27, issue of Jan. 22d 1876, my own opinion is that if the original field notes of the government survey say that the line between Sections 13 and 24 lies wholly in the lake; then all the land belongs in Section 24, and should be divided proportionally between the owners of fractional S. E. ¼ Section 24. Saying that the line is in the lake, fixes it there, just as much as to say that it passes through certain line trees, described in the notes.

When a section line is retraced it must pass through all the points mentioned in the field notes that can be found and identified however crooked the line may be. If an individual is allowed to correct the government survey, what is to prevent his own work being reviewed, and when will anything become permanent? C. W. B.

GRAPHICAL ANALYSIS OF ROOF TRUSSES.

BY CHAS. E. GREENE, A. M., PROF. OF CIVIL ENGINEERING, UNIVERSITY OF MICHIGAN.

XII.

Let us suppose that the weights which, in Fig. 23, rest upon the beam, are suspended by a cord from the points *a* and *b*, at the same level, being attached to the cord at the successive points *c*, *d*, *f* and *g*, vertically below their former positions at C, D, F and G. Let us further suppose that the amount of the weight at G alone is at present known. This cord can be treated as if it were a frame.

Entered according to Act of Congress, in the year 1875, by Charles E. Greene, in the Office of the Librarian of Congress, at Washington.

Taking the joint *g* under consideration, draw 5-4, vertically, equal to the weight, then 5-0 parallel to *a g*, and 4-0 parallel to *g f*. The two lines just drawn must be the tensions in *ag* and *gf*. For the joint *f*, *fg* is now known; therefore 4-3 parallel to the weight, and 3-0 parallel to *f e* will determine other forces at *f*. The side 4-3 must equal the weight at F, and must lie in the same straight line with 5-4, for this triangle was constructed on the side 4-0 previously found. Continuing the construction for the successive angles of the cord, we find that a vertical line 5-1 will represent by its several portions the successive weights, and that the tensions on the different parts of the cord will be given by the lines parallel to these parts, drawn from the points of division of the load line, and all converging to the common point 0. Draw 0-6, horizontally, and parallel to *a b*, this line will be the horizontal component of the tension at any point of the cord, and is here denoted by H. The form assumed by the cord for a given distribution of weights may be called the *curve of equilibrium*, as the system will be in equilibrium or at rest; and it is also called in mechanics a funicular polygon. Students of mechanics will recall the fact, so easily shown here, that the horizontal component H is a constant quantity at every point.

If now the cord, instead of being fastened at *a* and *b*, is attached to the two ends of a rigid bar *a b*, and the whole system is then suspended from A and B by two short cords, its equilibrium will not be disturbed. The pull 5-0 at *a* will be decomposed into 0-6, compression

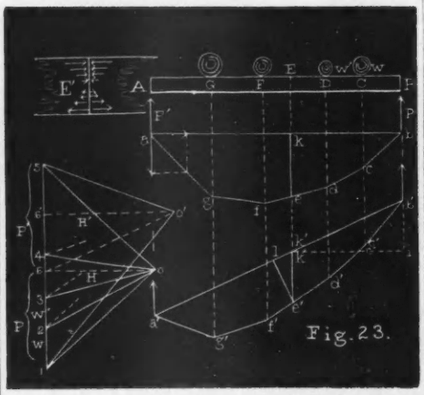


Fig. 23.

on *a b*, and 6-5, tension along *a* A. Similarly at *b*, 0-1 will be decomposed into 1-6 along *b* B and 6-0 along *b a*. 6-0 balances 0-6, while 1-6 and 6-5 must be the supporting forces at *b* and *a*. As the supporting forces do not depend upon the form of the frame or truss, the reactions which carry the beam at B and A must be these same quantities.

We may make the construction more general by drawing a *curve of equilibrium* from any point *a'*, vertically below A, that is, by determining the outline of a cord which will sustain in equilibrium the given weights at the given horizontal distances from A. Lay off the weights in succession from 5 to 1; assume any point o' arbitrarily and connect it with all the points of division of the load line. Commence at *a'*, and draw *a' g'* parallel to 5-o', stopping at the vertical dropped from G; then draw *g' f'*, parallel to 4-o', etc., and finally *c' b'*, parallel to 1-o'. That this will be the figure of a cord suspended from *a'* and *b'* follows from the preceding demonstration. Connect *b'* with *a'*, and the line parallel to *b' a'* from o' must strike the same point 6 which the line from o, parallel to *b a*, touched. The supporting forces, if *b' a'* exists, will be 1-6 and 6-5 as before; but 0'6' will be the horizontal component H' for this cord.

If we turn again to the first cord, attached at *a* and *b*, the pieces *a b* being dispensed with, and take any point of it *e*, the moment of all the forces on one side of the point must be the bending moment there; but as the cord is perfectly flexible, and is at rest, this bending moment will equal zero. Using, instead of 1-0, its two components 1-6=P and 6-0=H, multiplying each force by the perpendicular distance of its line of action from *e*, calling the combined moments of the weight on one side of *e* $\Sigma W \cdot L$ as before, and devoting the tendency to produce rotation in opposite ways by opposite signs, we shall have, for moments of forces on the right of, and around *e*,

$$P \cdot b\,k - \Sigma W \cdot L - H \cdot e\,k = 0, \qquad \text{or}$$

$$H \cdot e\,k = P \cdot b\,k - \Sigma W\,L.$$

But $P \cdot b\,k = P \cdot B\,E$, and $P \cdot B\,E - W\Sigma L = M$, the bending moment at the section E of the beam, as shown in the last article, therefore

$$M = H \cdot e\,k.$$

By a similar analysis of the lower cord we have

$$P' \cdot l'k' - \Sigma \cdot W \cdot L = (6\text{-}o) \cdot e'l = M.$$

From similarity of triangles $l\,e'k'$ and 6'o'6, we have

$$e'l : e'k' = 6'\text{-}o : 6\text{-}o, \text{ or } (6\text{-}o) \cdot e'l = (6'\text{-}o) \cdot e'k';$$

Therefore

$$M = (6'\text{-}o) \cdot e'k' = H' \cdot e'k'$$

as in the other case. The treatment is therefore general, and the bending moment at any section of the beam equals the product of H from the stress diagram by the verticle ordinate, below the section, from the cord to the line connecting its two extremities.

The relative situations of *a'* and *b'* will depend on the choice of the position of o', and this point may be taken wherever convenient. H' is measured by the same scale used for plotting 5-1, while *e'k'* must be measured by the scale to which A B is laid off. The two scales, one representing pounds and the other inches, need not be numerically the same. Their product will be inch-pounds. A single load on the beam will have for its curve of equilibrium two straight lines from *a'* and *b'*, meeting at a point vertically under the weight. A uniformly distributed load will give a parabola with the maximum ordinate at the middle of the span. This load may be treated as if concentrated at any convenient number of points along the beam, as we have done in getting the loads at the several divisions of a rafter, and the angles of the polygon will lie in the desired parabola. When the beam is inclined, the transverse components only of the load produce any bending, as explained for a uniform load in Fig. 22.

To determine next the moment of resistance for a particular form of cross-section:—Let us consider first a beam of rectangular cross-section, represented by A B C D of Fig. 24. The intensity of stress, as shown at E', Fig. 23, varies uniformly each way from the neutral axis. The neutral axis, lying through the centre of gravity, G, of the cross-section, will be at E F, the middle of the depth. The stress on the square inch will be most intense on the fibres at the edge A B or C D, and less intense on any intermediate layer, such as I K, in the proportion of E I to E A. If then we draw from G the lines G A and G B, and imagine that the layer I K is replaced by I'K', which has its breadth diminished in the same proportions, the total stress on I'K' if of the intensity found at A B, will be equal to the total stress of

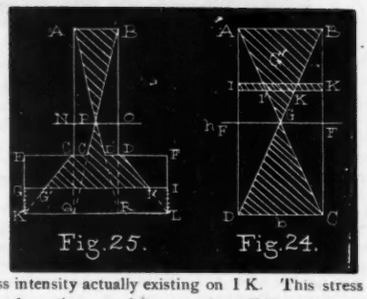


Fig. 25. Fig. 24.

less intensity actually existing on I K. This stress will also have the same leaverage about E F as that on I K. By the same reasoning for all layers of the beam, we obtain the two triangular, shaded areas, A B G and G D C, one of which, usually the upper one, when multiplied by the maximum intensity of stress, represents the total compression and the other the total tension at the section. The moment of either force about the neutral axis will be most readily obtained by considering the stress, which is now uniformerly distributed over the triangle, as concentrated at its centre of action, the centre of gravity G' of the triangle. This centre of gravity is at two-thirds of its height from the apex G.

Letting *b* represent the breadth, and *h* the height of the cross-section in inches, the area of one triangle will be $\frac{1}{2}\,b \cdot \frac{1}{2}\,h$; the lever arm will be $\frac{2}{3} \cdot \frac{1}{2}\,h$; and if *f* represent the maximum stress on the square inch at A B, since the tension and compression tend to produce rotation in the same direction, we add the moments of the two forces together and have

$$2\left(\frac{b\,h}{4} \cdot f \cdot \tfrac{1}{3}\,h\right) = \text{moment of resistance} = \tfrac{1}{6}\,f\,b\,h^2$$

Putting this equal to the bending moment M, we obtain

$$H' \cdot e'k' = \tfrac{1}{6}\,f\,b\,h^2.$$

If we select the maximum value of $c'k'$, introduce the safe working stress f for the extreme fibres, and assume either b or h, we can compute the other dimension. This will determine the beam when of uniform section throughout. If the cross-section is to vary, it will be proportioned to the bending moment at different points. As the stiffness of the beam depends principally upon h, the depth must not be made too small.

It is easier to compute the size of a beam of retangular cross-section by the above formula than to draw Fig. 24, but far a less regular section, where the areas and centres of gravity of the shaded portions are not so readily obtained, the graphical method for finding the moment of resistance is convenient.

In applying this method to a beam of the section shown in Fig. 25, we must first ascertain the centre of gravity of the section. By multiplying each rectangular area by the distance of its centre of gravity from either the top or bottom, adding the products, and dividing by the whole area; we find the distance of the neutral axis N O from that edge. If G I $=b$, A B $=b'$. G E $=h$, and C A $=h'$, we have

$$\frac{b\,h\cdot \frac{1}{2}\,h + b'h'\,(h+\frac{1}{2}\,h')}{b\,h + b'h'} = \text{distance of neutral axis [from G I.}$$

The construction of the shaded area A P B needs no explanation, as the remarks on Fig. 24 apply equally well here. The stress on the fibres at the edge G I will not be so great as at the edge A B, because they are not so far from the neutral axis. If the fibres at G I were removed to K L, so as to be equally remote with A B, they would be equally strained. Then to reduce the layer G I to one which, if it had the same intensity of stress with A B would give the same total stress which now exists on G I, project G I to K L, draw K P and L P, and G′I′ will be the desired reduced length. The remainder of the shaded area for the lower rectangle follows the usual rule. In the same way the fibres at C D will be projected at Q R, and, by drawing Q P and R P, we determine C′D′, and thus complete the shaded portion. These triangles, etc., can be readily scaled, or computed from known proportions of the beam, their centres of gravity found and the moment of resistance calculated.

This graphical method for finding the moment of resistance of a given cross-section was published in the English paper "*Engineering*" several years ago, and also in Baker's book "On the Strength of Beams, Columns and Arches." It can also be found in Wood's "Resistence of Materials, and Van Nostrand's Science Series, No. 19.

SELECTED LIST OF PATENTS

For the week ending February 25th, 1876.

Relating to Mining, Metallurgy, Engineering, &c., reported for ENGINEERING NEWS by Louis Bagger & Co., Solicitors of Patents, Washington, D. C.

173,132. Machine for Punching and Beveling Metal. J. Morgan, Pittsburg, Penn.

Every revolution of the crank causes the shaft and its pinion to make a part revolution each way, imparting at one half of its motion an advance motion to the rack, and at another half a reverse motion, during the former of which the extensible rack engages the pawl on the carriage, feeding it forward. The die is adjustable laterally and longitudinally, and the punch is attached eccentrically to its stem, and is rotatable to bring it to the different positions given to the die, all to vary the distance of the holes from the bevelled edge.

173,145. Ratchet Drill. R. R. Way, Halifax, Nova Scotia.

The teeth of the ratchet segment in the forms are inclined in opposite directions, in virtue of which one of said segments will engage with the toothed collar upon every movement of the operating lever, thereby causing the drill holder to receive a continuous rotary motion. The feed is effected by a pivoted dog which is operated to turn the rag wheel (clamped to its feed screw) once, during every revolution of the holder by the adjustable slide.

173,190. Machine for threading and cutting off Gas Pipe. Levi W. Stockwell, Ravenna, Ohio.

A cutting tool within one of the guides adjustable up to its work by a thumb-screw, and a clamp bearing against the cam-rings to fit the guides and the dies while the work is done.

173,191. Machine for Tapping Gas and Water Fittings. L. W. Stockwell, Ravenna, O.

The chuck-carrier is fed forward, presenting fittings to be acted upon in turn, and thrown back to its normal position when all the work has been done and the taps feed up and withdrawn, all automatically. Right and left hand screw-threads may be cut at the same time.

173,102. Mandrels for Rolling Metal Tubes. S. P. M. Tasker, Phila. Penn.

One of the rolls is made concave in the greater portion of its length, and is also so formed as to have a bearing near each end of a counter circular form to the swelled surface of the other roll; the surfaces of the two rolls, in virtue of this construction not being as liable to become impaired by wear at their places of contact as when they only touch tangentially.

173,207. Earth Augers. W. McK. Burns Concordia, Kansas,

The square auger shaft is rounded below the guide-tubes, to prevent twisting in the square part, and consequent jamming. The bit is formed on an acute pitch in the body portion, with a less acute point. A detachable T-plate is secured to the bottom of the auger, against which the pivoted reamer works. The cutter bit, reamer bit and blade bit are all connected to an arm on the shaft, and a straight blade projects down on one side of the bucket as far as the cutting bit, to balance the lateral strain.

173,208. Methods of obtaining Water. A. Byrane, Atchison, Kansas.

This is a method of gathering and drawing water from the earth by burying therein the perforated vessel A, and connecting the bottom thereof with the surface of ground by a pipe on a lower level than the vessel, as shown and described.

Contractors' Intelligence.

The Detroit Bridge and Iron Works have been awarded a contract for an iron bridge over the Wabash river at Logansport, Ind., at $46 per lineal foot.

The Lake Shore Foundry of Cleveland, has received the contract for furnishing the city lamp posts and frames for the year 1876. Some six hundred new posts are required annually.

The King Iron Bridge Company of Cleveland, are erecting one of their bridges, one hundred and twenty-six feet long, at Santa Rosa, Cal. With the completion of this order this company will have a bridge of their manufacture in every state of the Union, which cannot probably be said of any other bridge company in this country.

The Kittredge Cornice and Ornament Company of Salem, Ohio, have put a galvanized iron work in the court house in Van Wert county, Ohio, to the amount of $26, 000, beside filling a number of large orders in this year.

The Watson Manufacturing Company, at Paterson, N. J., are building a bridge 300 feet long, which is to cross the Rio Pomba in Brazil. It is in three spans and will cost $10, 500.

Proposals for Contracts.

We call the attention of our friends to the importance of the List of Contracts which we are endeavoring to make a feature of our journal, and we request that they will assist us in making it of interest by mailing us local papers containing "Proposals for Contracts," or sending us slips cut from such papers. It takes time to get into good running order, but we will accomplish our purpose after a while to the satisfaction, we trust, of the large number of our readers who are interested in this subject.

COUNTY POORHOUSE—Sealed proposals will be received until Tuesday the fourth day of April, at 12 o'clock noon, for the building of an additional Ward to the County Poorhouse building, according to plans and specifications to be seen at the office of the County Auditor, Marion, Iowa. By order of the Supervisors. Joseph Whitney, *Chairman.*

IMPROVEMENT OF TENNESSEE RIVER—Sealed proposals, in duplicate, will be received at this office until noon on Wednesday, March 22, 1876, for the construction of Locks in the Muscle Shoals Canal, Tennessee River, between Florence and Decatur, Alabama. Walter McFarland, *Major of Engineers*

U. S. Engineer Office, Chattanooga, Tenn., February 7, 1876.

JAIL AND SHERIFF'S RESIDENCE.—Sealed proposals will be received at the County Clerk's office in the city of Freeport, Ill., until March 22. 1876, at noon, for the furnishing of all materials and labor required in the erection, construction, and completion of a Jail and Sheriff's Residence in the city of Freeport, for the County of Stephenson, State of Illinois, according to plans and specifications for the same as furnished by T. J. Tolan & Son, Architects, of Ft. Wayne, Ind. Said buildings will be required to be finished and completed on or before the first day of November, 1876. I. F. Kleckner, *County Clerk.*

Freeport, Ill., Feb. 25, 1876.

SCAVENGER WORK.—Sealed proposals for the performance of the day scavenger work of Chicago, from May 1, 1876, will be received at the office of the Board of Health, No. 16 Honore Block, until 12 m. of Tuesday, March 14, 1876. G. W. Merrell' *Secretary Board of Health.*

Chicago, March 1, 1816.

TO RAILROAD CONTRACTORS—The "Wheeling and Lake Erie Railroad Company" invite proposals until March 20, 1876 (either separately or combined), for the construction and equipment of its line of road between Martin's Ferry and Sandusky, O., or for parts thereof. Also for railway materials. Particulars furnished on application. Joel Wood, *President.*

Martin's Ferry, O., Feb. 22, 1876

COUNTY JAIL.—The undersigned committee will receive sealed proposals for the erection of a county jail and jailer's residence in the city of Macomb, county of McDonough, Illinois, from the 25th day of February, 1876, to Tuesday, the 14th day of March, 1876. The proposals must be filed in the office of the county clerk of said county on or before 12 o'clock noon of Tuesday, the 14th day of March, 1876. Wm. C. McLeod, John Watson, D. M. Wyckoff, R. McClure, C. V. Chandler, *Committee.*

Macomb, Ill., Feb. 14th, 1876.

COURT HOUSE.—Sealed proposals for the erection of a court house for Story county, Iowa, will be received at the office of the undersigned in Nevada, Iowa, until 12 o'clock, noon, March 15th, 1876. Plans and specifications will be on file in the Auditor's office at Nevada, Iowa, on and after March 1st, 1876. John R. Hays, *County Auditor.*

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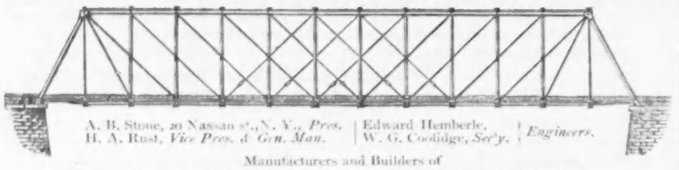

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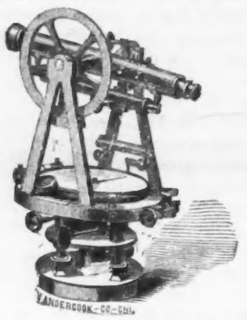

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